BUILDING ACOUSTICS AND COMMUNITY NOISE RESEARCH AREAS

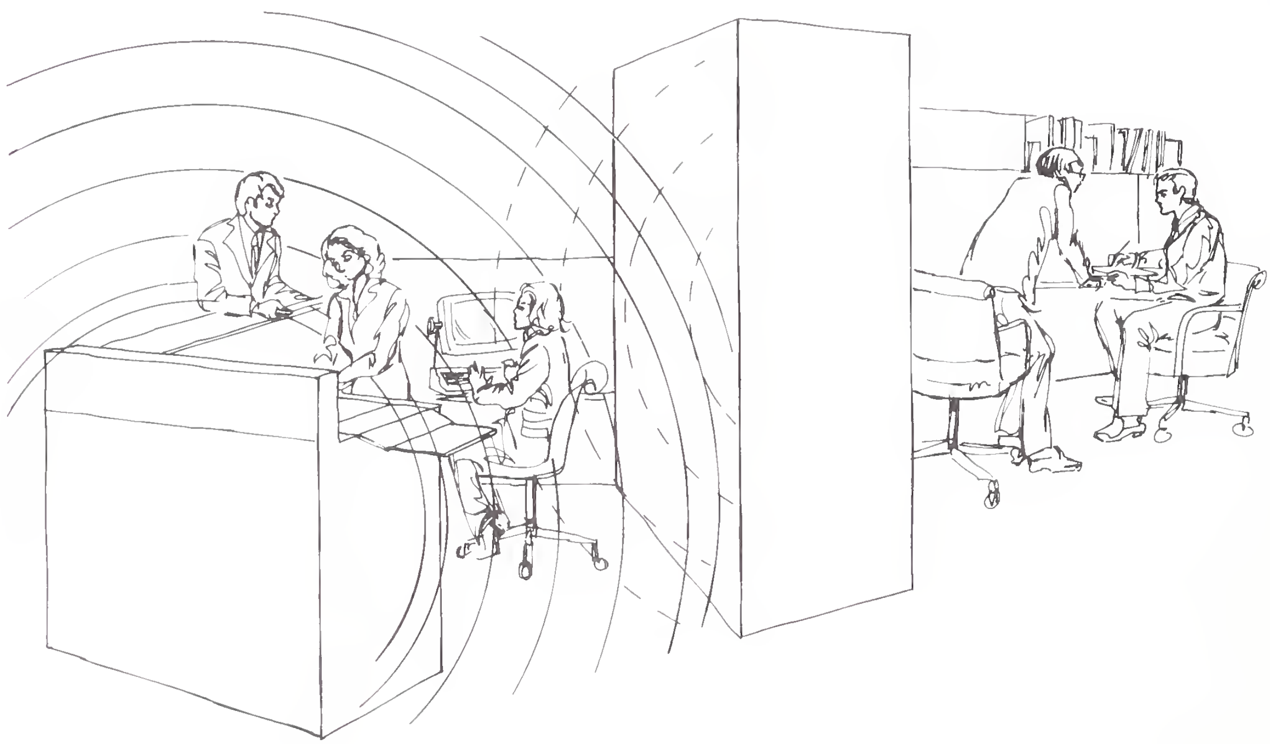
U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

National Engineering Laboratory / Center for Building Technology / Environmental Research Design Division

BUILDING ACOUSTICS

Two major programs are beginning in building acoustics: the first, to improve indoor acoustics and the second, to improve the design and construction of buildings near external noise sources. The first program, improvements in indoor acoustics, will research reverberation predictions and computation methods. This approach will be used because: 1) reverberation control strategies affect the efficiency of spatial arrangements of building interiors; 2) accurate reverberation prediction cannot now be made due to a lack of reliable sound absorption data, particularly for newly developed generic building materials; and 3) predictions cannot be made precisely because of insufficient knowledge of the effects of field conditions on absorption. Both field and laboratory studies of the sound absorption of non-proprietary materials, meaning those that absorb sound but are not manufactured for that purpose, will be conducted. It will then be possible to develop methods to improve the prediction of reverberation time.

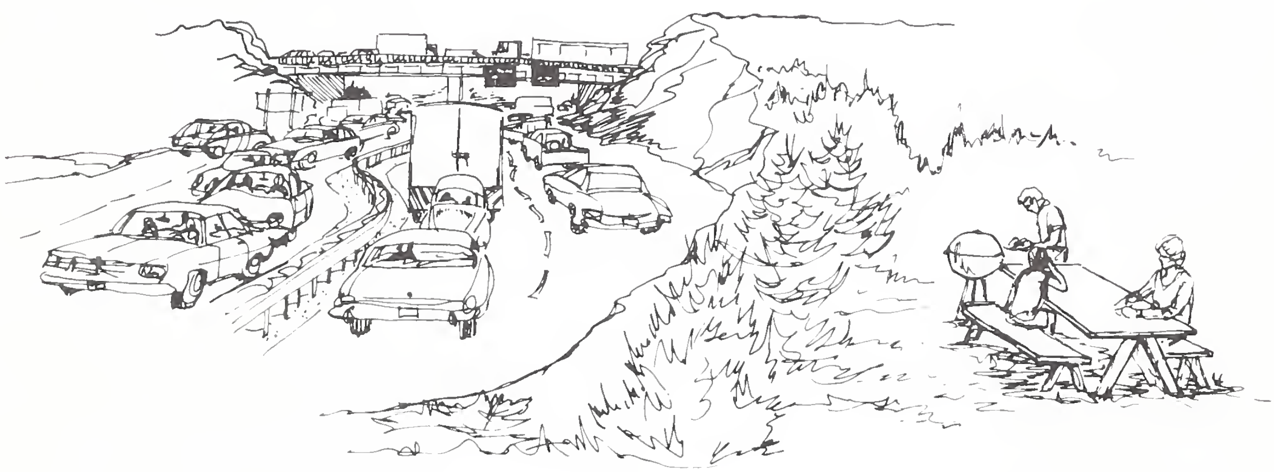
The second major program in building acoustics is designed to determine the in situ noise isolation of building envelopes, building elements, materials and subsystems, including indoor elements. Emphasis will be placed on determining the noise isolation produced by walls, roofs, doors and windows acting in combination since the overall isolation of these elements is poorly defined. This program will be developed because protective design and construction technology will be required for buildings built near external noise sources. In addition to these acoustic studies, the program will address the interdependencies between acoustical, fire, and energy characteristics of buildings and building subsystems.



HUMAN RESPONSE TO NOISE

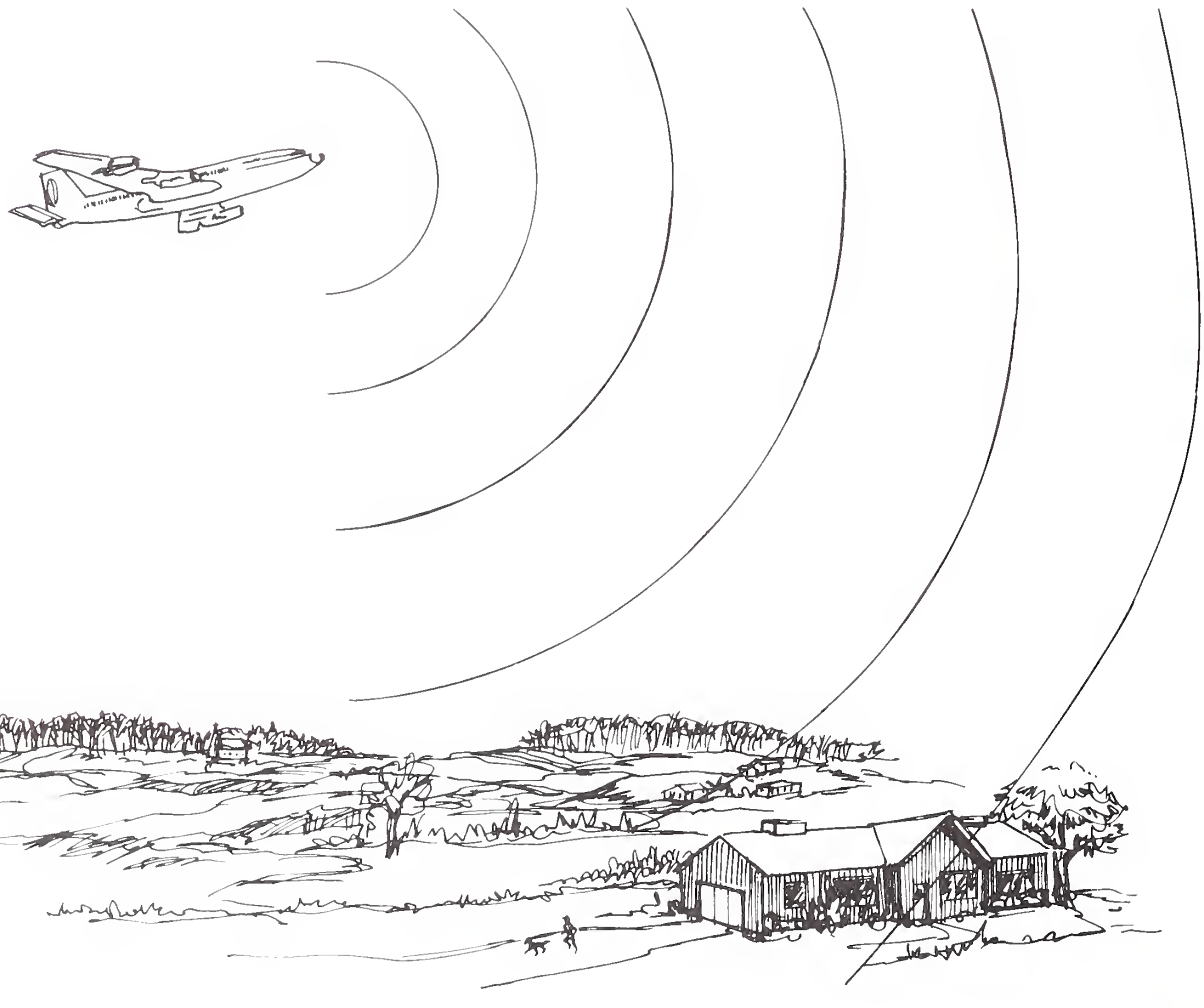
The need to relate the acoustical environment to the human requirements of those using buildings and communities is central to any effort in building acoustics and noise management. The problem of acoustical and noise criteria for buildings will be addressed by both laboratory and field studies of human responses to acoustical environments experienced in urban areas and building spaces. This approach will be taken because acoustical criteria for land use, siting and building spaces greatly affect the usefulness and economy of buildings as well as determine, to a large extent, appropriate building methods.

The difficulty of choosing criteria today is due to the lack of an adequate rating scheme for better prediction of the human response to acoustical phenomena. Better prediction of the human response to acoustical phenomena will make it possible to rate existing environments. Once a rating scheme is in hand, then an empirical basis for selecting criteria can follow. The development of such a rating scheme is difficult because it depends on an understanding of the many factors which affect human responses. Among those factors: the use of the particular environment; the physical parameters of the sound—its amplitude and frequency spectrum; and the variation of both of these quantities with time. To be of practical use to designers, a rating scheme must combine these three parameters into a meaningful expression. These determinations will be carried out in controlled laboratory conditions using psychoacoustic techniques and in field studies that will include social surveys of individual responses to noise in day-to-day environments. Special attention will also be devoted to the development of field measurement and evaluation procedures for completed buildings in order to assess the adequacy of design criteria presently in use or developed. The human response studies on the reactions of people to highway noise in laboratory experiments will assess the efficacy of current and proposed noise rating schemes to predict the human responses to traffic noise. Also, the reaction of people to the noise from high voltage transmission lines ("corona noise") is being simulated in the Division's acoustics laboratories.



SOUND PROPAGATION IN BUILDING ENVIRONS

The protection of building environs requires an understanding of the noise levels that will reach it. The phenomenon of sound propagation along city streets, highways, around and between buildings, and in "urban canyons" is not well understood. Thus, noise levels of any community location cannot be predicted with confidence. A program for developing systematic predictive methods for sound propagation in urban and surburban areas will be started. The effects of sound propagation as affected by atmospheric turbulence, temperature, thermal inversions, wind, ground impedance, and barriers (including the buildings themselves) will be determined through field investigations. Particular emphasis will be given to characterizing the micro-climates of "canyons" because of their importance to acoustical transportation, land use planning, and energy considerations. The important parameters identified in the field investigations will be further examined in scale modeling studies leading to sound propagation prediction methods.



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